

CLAIMS

1. A medical device for use in a mammal comprising:

(a) a bioresorbable bulk material; and

(b) resorbable particles embedded in said bioresorbable bulk material, said resorbable particles causing said bioresorbable bulk material to resorb upon contact with a body fluid at a controllable resorption rate.

2. The medical device of claim 1 wherein said resorbable particles resorb upon contact with a body fluid at a resorption rate that is different from the resorption rate of said bioresorbable bulk material.

3. The medical device of claim 2 wherein the resorption rate of said resorbable particles is greater than the resorption rate of said bioresorbable bulk material.

4. The medical device of claim 1 wherein said bioresorbable bulk material comprises an ionically crosslinked polymeric material.

5. The medical device of claim 1 wherein said bioresorbable bulk material comprises a covalently crosslinked polymeric material.

6. The medical device of claim 4 wherein said ionically crosslinked polymeric material comprises at least one polymer or copolymer made from at least one member of the group consisting of polyacrylic acids, polymethacrylic acid, polyethylene amine, polysaccharides, alginic acid, pectinic acids, carboxy methyl cellulose, hyaluronic acid, heparin, chitosan, carboxymethyl chitosan, carboxymethyl starch, carboxymethyl dextran, heparin sulfate, chondroitin sulfate, cationic starch, and salts thereof.

1 7. The medical device of claim 4 wherein said ionically crosslinked polymeric material is an
2 ionically crosslinked polymer hydrogel and has a water content of less than 90% by weight and
3 possesses sufficient mechanical strength to serve as a stent, a catheter, a cannula, a plug, a
4 constrictor, a sheet, a filler, a bone anchor, a plate, a rod, a seed, a tube, or a portion thereof.

1 8. The medical device of claim 1 wherein said medical device is a stent, a catheter, a
2 cannula, a plug, a constrictor, a sheet, a filler, a bone anchor, a plate, a rod, a seed, a tube, or a
3 portion thereof.

1 9. The medical device of claim 1 wherein each of said resorbable particles comprises an
2 organic compound.

1 10. The medical device of claim 1 wherein each of said resorbable particles comprises a
2 soluble or degradable inorganic compound.

1 11. The medical device of claim 9 wherein said organic compound is a sugar or a water
2 soluble organic salt.

1 12. The medical device of claim 1 wherein each of said resorbable particles comprises an
2 organic or inorganic crystal or powder aggregate.

1 13. The medical device of claim 1 wherein each of said resorbable particles comprises a
2 water-swellaable polymer.

1 14. The medical device of claim 13 wherein said water-swellaable polymer comprises a
2 material selected from the group consisting of polysaccharides, polyglycolic acid, polylactic acid,
3 cellulose derivatives, hyaluronic acid, and colloid/hydrogel. *Alginate is polysach.*

1 15. The medical device of claim 1 wherein the size of each of said resorbable particles is
2 from about 5 nm to about 1 mm.

3
1 16. The medical device of claim 1 wherein the ratio of said resorbable particles in said
2 bioresorbable bulk material is equal to or less than about 50 % by volume.

3
1 17. The medical device of claim 1 wherein each of said resorbable particles comprises a
2 polymer selected from the group consisting of polysaccharides, polyglycolic acid, polylactic acid,
3 and polycaprolactone and copolymers of any two or three of glycolic acid, lactic acid, and
4 caprolactone monomers.

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1 18. A medical device for use in a mammal comprising:
2 (a) a bioresorbable bulk material; and
3 (b) particles embedded in said bioresorbable bulk material, said particles comprising a magnetic,
4 paramagnetic, or superparamagnetic material and causing said bioresorbable bulk material to
5 resorb upon contact with a body fluid at a controllable resorption rate.

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1 19. The medical device of claim 18 wherein said controllable resorption rate of said
2 bioresorbable bulk material is faster than a resorption rate of said bioresorbable bulk material
3 without said embedded particles.

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1 20. The medical device of claim 19 wherein the size of each of said particles is from about 5
2 nm to about 1 mm.

3
1 21. The medical device of claim 19 wherein the volume percentage of said resorbable
2 (particles in) said bioresorbable bulk material is equal to or less than about 50 %.

3
1 22. A method for controlling resorption of a bioresorbable material in a device for use in a
2 mammal, said method comprising:
3 (a) providing a bioresorbable bulk material;
4 (b) embedding resorbable particles in said bioresorbable bulk material, said resorbable particles
5 resorb faster upon contact with a body fluid than said bioresorbable bulk material; and

(c) contacting a body fluid with said bioresorbable bulk material and said resorbable particles thereby causing said bioresorbable bulk material to resorb at a controllable resorption rate.

23. The method of claim 22 wherein said controllable resorption rate is different from the resorption rate of said bioresorbable bulk material without said embedded resorbable particles.

24. The method of claim 23 wherein said bioresorbable bulk material comprises an ionically crosslinked polymeric material.

25. The method of claim 23 wherein said bioresorbable bulk material comprises a covalently crosslinked polymeric material.

26. The method of claim 23 wherein said resorption rate is controlled by varying the size or the amount of said resorbable particles.

27. The method of claim 23 wherein said resorbable particles swell upon contact with said body fluid.

28. The method of claim 23 wherein said resorbable particles hydrolyze into by-products soluble in said body fluid upon contact with said body fluid.

29. A method for controlling resorption of a bioresorbable material in a device, said method comprising:

(a) providing a bioresorbable bulk material;

(b) embedding particles having a pre-selected magnetic property in said bioresorbable bulk material;

(c) providing a magnetic field surrounding said particles; and

(d) inducing activation or vibration of each of said particles thereby causing said bioresorbable bulk material to resorb at a controllable resorption rate.

30. The method of claim 29 wherein said controllable resorption rate is different from a resorption rate of said bioresorbable bulk material without said embedded particles.

31. The method of claim 30 wherein each of said particles is magnetic, paramagnetic, or superparamagnetic and wherein said inducing activation or vibration of each of said particles is by varying said magnetic field surrounding said particles.

32. A method for controlling resorption of a medical device, said method comprising
(a) providing a bioresorbable bulk material shaped as a medical device;
(b) providing a coating material comprising a dissolvable polymeric material that allows diffusion of a body fluid through said coating material at a controllable rate; and
(c) coating said medical device with said coating material.

33. A composition for use in a device in a mammal, said composition comprising:
(a) a bioresorbable bulk material; and
(b) resorbable particles embedded in said bioresorbable bulk material, said resorbable particles causing said bioresorbable bulk material to resorb upon contact with a body fluid at a controllable resorption rate.

34. A composition for use in a device in a mammal, said composition comprising:
(a) a bioresorbable bulk material; and
(b) resorbable particles embedded in said bioresorbable bulk material, said resorbable particles having a resorption rate that is different from a resorption rate of said bioresorbable bulk material and said resorbable particles causing said bioresorbable bulk material to resorb at a controllable rate upon contact with a body fluid.

35. The composition of claim 34 wherein the resorption rate of said resorbable particles is greater than the resorption rate of said bioresorbable bulk material.

1 36. The composition of claim 34 wherein said bioresorbable bulk material comprises an
2 ionically crosslinked polymeric material or a covalently crosslinked polymeric material.
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1 37. The composition of claim 34 wherein each of said resorbable particles comprise an
2 organic compound.
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1 38. The composition of claim 34 wherein each of said resorbable particles comprise a soluble
2 or degradable inorganic compound.
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1 39. The composition of claim 34 wherein each of said resorbable particles comprise organic
2 or inorganic crystals or powder aggregates.
3

1 40. The composition of claim 34 wherein each of said resorbable particles comprise a
2 polymer.
3

1 41. The composition of claim 34 wherein the size of said resorbable particles is about 5 nm to
2 about 1 mm.
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1 42. The composition of claim 34 wherein the volume percentage of said resorbable particles
2 in said bulk material is equal to or less than about 50 %.
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1 43. The composition of claim 34 wherein each of said resorbable particles comprise a
2 magnetic, paramagnetic, or superparamagnetic material.
3

1 (44.) A system for controlled delivery of a pharmaceutical agent in the body of a mammal, said
2 system comprising a carrier device having coated thereon a bioresorbable ionically or covalently
3 crosslinked polymeric material and incorporated therein said pharmaceutical agent.
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1 (45.) A coating material for use in a medical device for regulating resorption of said medical
2 device, said coating material comprises a bioresorbable ionically or covalently crosslinked

3 polymeric material that allows diffusion into said medical device by a body fluid at a pre-selected
4 rate.